

CLAIM OR CLAIMS

1. A damping system for arresting the motion of a body of small mass such as a photographic shutter or the like comprising:
 - a) a drive arm supported to swing through an arcuate path of travel;
 - b) a detent having opposite ends disposed to arrest the swinging movement of the drive arm at each end of the arcuate path of travel;
 - c) shaped bumpers on each of the opposite ends of the detent, the bumpers being composed of a polyethylene having a molecular weight of 3 to 6 million; and
 - d) a damper on the drive arm engageable with each of the shaped bumpers, the dampers being composed of a polyurethane material.
2. A damping system as in Claim 1 wherein the bumpers and the damper are shaped to provide substantially point contact therebetween during the duration of the engagement as the swinging of the drive arm through its arcuate path of travel carries the damper into engagement with the bumper.
3. A damping system as in Claim 2 wherein the point contact is provided by one of the damper and bumpers having a contact portion that is a straight edge and the other a contact portion that is a curved surface.
4. A damping system as in Claim 1 wherein the detent comprises:
 - a) a spring wire formed with a central spine and two arms extending outward in opposite directions from the spine;
 - b) each arm having an outward extending end bent downwardly from the plane of the arm, the two downwardly bent ends defining a space therebetween; and
 - c) one of the shaped bumpers being attached to each of the downwardly bent ends.

5. A damping system as in Claim 4 wherein the central spine is pivotally supported by a support wire having fixed ends.
6. A damping system as in Claim 4 wherein:
 - a) the drive arm is a flat member having a beam upstanding from a surface of the drive arm and into the space between the two downwardly bent ends of the arms, the beam having opposite sides; and
 - b) a damper fixed to each of the opposite sides of the beam.
7. A damping system as in Claim 6 wherein each damper is generally triangular in cross section and is fixed a side of the beam so as to present a straight corner for impacting the bumper.
8. A damping system as in Claim 7 wherein each bumper has a curved surface to receive the impact of the straight corner of the damper thereby providing substantially a point contact of impact between the two.
9. A damping system as in Claim 7 wherein the beam is generally triangular in cross section.
10. A damping system as in Claim 4 wherein the end of each arm is bent downward at an angle of about 77 degrees from the plane of the arm.
11. A damping system as in Claim 1 wherein the dampers comprise a polyurethane material having an ASTM D2240 Shore A Durometer Impact at 73°F (23°C) of about 58,

an ASTM D575 glass transition temperature of about 18°F (-8°C), a second ASTM D2632 rebound at 20°C of 0.0, and a Compression Modulus about 845psi (5826kPa).

12. A damping system for arresting the motion of a body of small mass such as a photographic shutter comprising:

a) a drive arm supported to swing through an arcuate path of travel, the drive arm having one pivotally linked to a photographic shutter operated ring;

b) a beam fixed to a surface of the drive arm, the beam having opposite upstanding sides;

c) a damper fixed to each of the opposite sides of the beam, each damper being composed of a damped polyurethane having an ASTM D2240 Shore A Durometer hardness of about 58;

d) an elongated detent support, the support being fixed at its opposite ends;

e) a detent having a central spine and outward extending arms, each arm having an outward extending end that is bent downwardly with respect to the plane of the arm and the spine being pivotally supported by the detent support;

f) a bumper on each of the downwardly bent ends of the outwardly extending arms, each bumper comprising a polyethylene having a molecular weight of 3 to 6 million, each bumper being disposed to receive the impact of a detent thereagainst as the drive arm is swung through its arcuate path of travel; and

g) the damper and bumper being configured to provide a substantially point contact therebetween during the duration of the impact of the damper against the bumper.

13. A damping system as in Claim 12 wherein the damper has a substantially straight corner that impacts against the bumper and the bumper has a curved surface to receive the impact of the damper thereagainst.

14. A damping system as in Claim 13 wherein each outward extending end of each arm is bent downwardly at an angle of about 77 degrees with respect to the plane of the arm.

15. A rotary photographic shutter or the like including a plurality of shutter blades movable between an open and a closed position, a drive means including an actuator for moving the shutter blades between the open and closed positions and a damping system operable to arrest the movement of the drive means at one of the open and closed positions.

16. A rotary photographic shutter comprising:

- a) a base plate having a central aperture;
- b) a plurality of rotating ring operable shutter blades supported by the base plate for opening and closing the aperture; and
- c) a damping system on the base plate operable to dampen the opening and closing of the rotating ring operable shutter blades.

17. A rotary photographic shutter as in Claim 16 comprising:

- a) a drive arm pivotally supported on the base plate to swing back and forth through a defined arc, the swing of the drive arm in one direction acting to move the shutter blades to an open position and the swing in a return direction acting to move the shutter blades to a closed position; and
- b) the damping system arranged to arrest the swing of the drive arm at each end of the arc.

18. A rotary photographic shutter as in Claim 16 wherein the damping system comprises:

- a) a drive arm pivotally supported on the base plate to swing back and forth through a defined arc, the swing of the drive arm in one direction acting to move the shutter

blades to an open position and the swing in a return direction acting to move the shutter blades to a closed position;

- b) a detent having opposite ends disposed to arrest the swinging movement of a shutter blade operating drive arm at each end of the swing;
- c) bumpers on each of the opposite ends of the detent; and
- d) at least one damper on the drive arm positioned to strike and engage against each of the shaped bumpers at the limits of the swing of the drive arm.

19. A rotary photographic shutter as in Claim 18 wherein the bumpers and the damper are shaped to provide substantially point contact therebetween during the duration of the engagement.

20. A rotary photographic shutter as in Claim 17 wherein the damping system includes:

- a) bumpers carried by one of the driving arm and base plate composed of a polyethylene having a molecular weight of 3 to 6 million; and
- b) a damper on the other of the drive arm and base plate composed of a polyurethane material that under goes a transformation from a glass phase to a rubber phase when it strikes the bumpers.

21. A damping system for arresting motion of a body moving through a path of travel comprising:

- a) a bumper located at an end of the path of travel;
- b) a damper carried by the body and positioned to strike the bumper at the end of the path of travel, the damper comprising a material that undergoes a transformation from a glass phase to a rubber phase when struck thereby causing a tendency of the damper to stick to the bumper; and

c) the damper and bumper having shapes that limit the area of contact between the damper and bumper.

22. A damping system as in Claim 20 wherein the shape of the damper and bumper limit the contact therebetween to substantially a point contact.

23. A damping system for arresting motion of a body moving through a path of travel comprising:

a) a bumper located at an end of the path of travel, the bumper composed of a polyethylene having a molecular weight of 3 to 6 million; and

b) a damper carried by the body and engageable against the bumper, the damper composed of a polyurethane material.

24. A damping system as in Claim 23 wherein the polyurethane material undergoes a transformation from a glass phase to a rubber phase when struck thereby causing a tendency of the damper to stick to the bumper and the damper and bumper having shapes that limit the contact area of one against the other.

25. A damping system for arresting motion of a body moving through a path of travel as in Claim 23 wherein the damper comprises a damped polyurethane having an ASTM D2240 Shore A Durometer hardness of about 58.

26. A damping system for arresting motion of a body moving through a path of travel as in Claim 23 wherein the damper comprises a polyurethane having an ASTM D2240 Shore A Durometer Impact at 73°F (23°C) of about 58, an ASTM D575 glass transition temperature of about 18°F (-8°C), a second ASTM D2632 rebound at 20°C of 0.0, and a Compression Modulus about 845psi (5826kPa).

27. A damping system for arresting motion of a body moving through a path of travel as in Claim 23 wherein the bumpers and damper are shaped to provide substantially point contact therebetween during the duration of the engagement.

28. A damping system for arresting motion of a body moving through a path of travel as in Claim 23 wherein the damper has a cross section providing a straight corner edge arranged to strike the bumper.

29. A damping system for arresting motion of a body moving through a path of travel as in Claim 28 wherein the bumper has a curved surface to receive the strike of the damper straight corner edge thereby providing the substantially point contact therebetween.

30. A damping system for arresting motion of a body moving through a path of travel as in Claim 23 wherein the moving body is a component of a rotary photographic shutter.

31. A damping system for arresting the motion of a body moving through a path of travel comprising:

- a) a damper carried by the body, the damper having a cross sectional shape providing a straight corner edge;
- b) a spring mounted bumper located at an end of the path of travel, the spring urging the bumper towards the plane of the path of travel;
- c) the bumper having a curved surface to receive a strike of the damper straight corner edge as the body moves to the end of its path of travel thereby providing substantially point contact between the damper and the bumper, and the bumper being positioned so as to receive the strike at a generally central location on the bumper between its opposite ends; and

d) the spring providing sufficient bias to prevent the force of the strike from moving the bumper so far in a direction normal to the plane of the path of travel that the damper passes over one or another of the opposite ends.

32. A damping system as in Claim 31 wherein:

a) the damper comprises a material that undergoes a transformation from a glass phase to a rubber phase when struck thereby causing a tendency of the damper to stick to the bumper; and

b) the damper and bumper having shapes that limit the contact area between the damper and bumper.